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Preface

Linear Logic was introduced by Jean-Yves Girard in a paper published in this Journal in 1987.[1] Since then, it has become a major focus of research at the meeting-point of logic, category theory and Computer Science, both as an object of study in its own right, and for the light it may shed on computational notions such as complexity, concurrency, sharing, and the control of resources.

This special issue on Linear Logic arises from the 8th Workshop on Mathematical Foundations of Programming Semantics held in Oxford in March 1992. I had been asked to organize a special session on Linear Logic, to help expose the MFPS community to this significant recent development. The session comprised invited talks by Jean-Yves Girard, Philip Scott and Jean-Marc Andreoli, and a lively discussion session on the emerging significance of Linear Logic for Computer Science. Andre Scedrov had previously given an overview of Linear Logic as one of the invited lectures at the Workshop. The response to the call for papers for the special issue of *Theoretical Computer Science* for MFPS '92 confirmed the level of interest in the community. There were enough papers on Linear Logic to warrant a separate issue of their own; the remaining papers will be published in two other issues of *TCS*.

The papers in this issue can be classified into three groups:

- The papers by Abramsky on "Proofs as processes" and by Bellin and Scott "On the π-calculus and linear logic" are concerned with the connection between Linear Logic and concurrent computation. Abramsky's motivation is to develop a version of the propositions-as-types paradigm for concurrency; Bellin and Scott build on his work to develop extensive connections between the proof theory of Linear Logic and Robin Milner's π-calculus.
- The papers by Galmiche and Perrier, "On proof normalisation in linear logic", and by Mascari and Pedicini on "Head linear reductions and pure proof nets" contribute to the proof theory of Linear Logic. Galmiche and Perrier give a detailed analysis of permutability of inferences in the sequent calculus presentation of Linear Logic, leading to a notion of normalisation for this calculus. Mascari and Pedicini develop an analogue to the Böhm-out lemma, a classical result of the

[1] J.-Y. Girard, Linear logic, *Theoret. Comput. Sci.* **50** (1) (1987) 1–102.

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λ-calculus, in the setting of pure nets, a variation of Linear Logic proof nets introduced by Danos to study λ-calculus from the perspective of Linear Logic.

- The papers by Lincoln and Winkler on "Constant-only multiplicative linear logic is NP-complete", and by Lincoln and Scedrov on "First-order linear logic without modalities is NEXPTIME-hard" exemplify another major line of research in Linear Logic, which is based on the logic programming paradigm of programs as theories, computation as proof-search, rather than the functional programming paradigm of programs as proofs, computation as normalisation. This has potential applications to Linear Logic based logic programming languages, and also a foundational interest, since various fragments of Linear Logic under this computation as proof search paradigm correspond very tightly to natural machine classes, leading to a wealth of complexity results for these fragments. The papers by Lincoln, Scedrov and Winkler contribute to this literature. The result by Lincoln and Winkler is particularly striking: an apparently innocuous fragment of Linear Logic, the formulas built from the multiplicative units by the binary multiplicative connectives, is already NP-complete.

The papers in this issue illustrate the lively state of research into Linear Logic, and its deepening applications to a range of topics in Theoretical Computer Science.

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